Claims

[c1] 1.A compound electrode comprising: a first layer of a first electrically conducting material, and a plurality of elongated members in electrical contact with said first layer, said elongated members comprising a second electrically conducting material.

[c2] 2.The compound electrode of claim 2, wherein a thickness of said elongated members is greater than a thickness of said first layer, said thickness of said elongated members being measured substantially perpendicularly to said first layer.

[c3] 3.The compound electrode of claim 2, wherein said elongated members form intersecting lines.

[c4] 4.The compound electrode of claim 2, wherein a total surface area of said elongated members overlapping said first layer is less than about 50 percent of a surface area thereof.

[c5] 5.The compound electrode of claim 2, wherein a total surface area of said elongated members overlapping said first layer is less than about 25 percent of a surface area thereof.

[c6] 6.The compound electrode of claim 2, wherein a total surface area of said elongated members overlapping said first layer is less than about 10 percent of a surface area thereof.

[c7] 7.The compound electrode of claim 2, wherein an area surrounding a point of short circuit in said first layer is capable of being ablated by heat generated by said short circuit.

[c8] 8.A compound electrode comprising: a first layer of a first electrically conducting material; a second layer of a second electrically conducting material having conductivity less than that of said first layer, said second layer being in contact with said first layer; and a third layer of a third electrically conducting material, said third layer being in contact with said second layer.

[c9] 9.The compound electrode of claim 8, wherein said second electrically conducting material is an electrically conducting organic material.

[c10] 10.The compound electrode of claim 9, wherein said third layer has a thickness greater than that of said first layer.

[c11] 11.The compound electrode of claim 9, wherein an area of said first layer surrounding a point of short circuit in said first layer, and an area of said second layer above said short circuit are capable of being ablated by heat generated by said short circuit.

[c12] 12.An organic electronic device comprising:
(a) a first electrode;
(b) a second electrode that comprises a first layer of a first electrically conducting material, and a plurality of elongated members of a second electrically conducting material, said elongated members being disposed on and in electrical contact with said first layer; and
(c) at least an electrically and optically active organic material disposed between said first electrode and said first layer of said second electrode.

[c13] 13.The organic electronic device of claim 12, wherein a thickness of said elongated members is greater than a thickness of said first layer, said thickness of said elongated members being measured substantially perpendicularly to said first layer.

[c14] 14.The organic electronic device of claim 12, wherein said elongated members form intersecting lines.

[c15] 15.The organic electronic device of claim 12, wherein a total surface area of said elongated members overlapping said first layer is less than about 50 percent of a surface area thereof.

[c16] 16.The organic electronic device of claim 12, wherein a total surface area of said elongated members overlapping said first layer is less than about 25 percent of a surface area thereof.

[c17] 17.The organic electronic device of claim 12, wherein a total surface area of

said elongated members overlapping said first layer is less than about 10 percent of a surface area thereof.

[c18] 18.The organic electronic device of claim 12, wherein an area surrounding a point of short circuit in said first layer is capable of being ablated by heat generated by said short circuit.

[c19] 19.An organic electronic device comprising:
(a)a first electrode;
(b)a second electrode comprising a first layer of a first electrically conducting material; a second layer of a second electrically conducting material, said second layer being in contact with said first layer; and a third layer of a third electrically conducting material, said third layer being in contact with said second layer; said second electrically conducting material having conductivity less than those of said first and third electrically conducting materials; and
(c)at least an electrically and optically active organic material disposed between said first electrode and said first layer of said second electrode.

[c20] 20.The organic electronic device of claim 19, wherein said third layer has a thickness greater than that of said first layer.

[c21] 21.The organic electronic device of claim 19, wherein an area of said first layer surrounding a point of short circuit in said first layer, and an area of said second layer above said short circuit are capable of being ablated by heat generated by said short circuit.

[c22] 22.The organic electronic device of claim 12, wherein said device is an organic electroluminescent device ("OELD"), said first electrode is an anode, said second electrode is a cathode, and said electrically and optically active organic material is an organic EL material.

[c23] 23.The organic electronic device of claim 22, wherein said thickness of said first layer is in a range from about 1 nm to about 25 nm, and said thickness of said elongated members is in a range from about 10 nm to about 500 nm.

[c24] 24.The organic electronic device of claim 23, wherein said first and second

electrically conducting materials are the same, and are selected from the group consisting of K, Li, Na, Mg, La, Ce, Ca, Sr, Ba, Al, Ag, In, Sn, Zn, Zr, Sm, Eu, alloys thereof, and mixtures thereof.

[c25] 25.The organic electronic device of claim 23, wherein said first and second electrically conducting materials are different, and are selected from the group consisting of K, Li, Na, Mg, La, Ce, Ca, Sr, Ba, Al, Ag, In, Sn, Zn, Zr, Sm, Eu, alloys thereof, and mixtures thereof.

[c26] 26.The organic electronic device of claim 22, wherein said organic EL material is selected from the group consisting of poly(N-vinylcarbazole); poly(9,9-dihexylfluorene); poly(dioctylfluorene); poly{9,9-bis(3,6-dioxaheptyl)-fluorene-2,7-diyl}; poly(2-decyloxy-1,4-phenylene); poly(di-n-butylsilane); poly(di-n-pentylsilane); poly(di-n-hexylsilane); poly(methylphenylsilane); poly{bis(p-butylphenyl)silane}; 1,3,5-tris{n-(4-diphenylaminophenyl) phenylamino} benzene; phenylanthracene; tetraarylethene; coumarin; rubrene; tetraphenylbutadiene; anthracene; perylene; coronene; aluminum-acetylacetonate; gallium-acetylacetonate; indium-acetylacetonate; aluminum-(picolymethylketone)-bis{2,6-di(t-butyl)phenoxide}; scandium-(4-methoxy-picolylmethylketone)-bis(acetylacetonate); chelated oxinoid compounds; poly {2-methoxy-5(2'-ethyl-hexyloxy)-1,4-phenylene-1,2-ethenylene-2,5-dimethoxy-1,4-phenylene-1,2-ethenylene}; dibenzotetraphenylperiflanthene; polythiophene; perylene tetraesters; triphenylene hexaethers; amino-substituted perylene derivatives; azlactone derivatives; derivatives of pentacene; derivatives of pyran; porphyrins of platinum, palladium, europium, or zinc; malenitriledithiolate phosphonate complexes of platinum, palladium, or zinc; derivative of europium (III) phenanthroline; and iridium (III) bis{2-(2'-benzothienyl)-pyridinato-N-$C^{3'}$}(acetylacetonate).

[c27] 27.An OELD comprising:

(a)a first electrode;

(b)a second electrode that comprises a first layer of a first electrically conducting material, and a plurality of elongated members comprising a second electrically conducting material, said elongated members being disposed on

said first layer; and

(c)at least an organic EL material disposed between said first electrode and said first layer of said second electrode;

wherein said first electrode comprises a substantially transparent electrically conducting material; said first and second electrically conducting materials of said second electrode are selected from the group consisting of K, Li, Na, Mg, La, Ce, Ca, Sr, Ba, Al, Ag, In, Sn, Zn, Zr, Sm, Eu, alloys thereof, and mixtures thereof; said first layer of said second electrode has a thickness in a range from about 1 nm to about 25 nm; said elongated members have a thickness in a range from about 10 nm to about 500 nm, said thickness being measured substantially perpendicularly to said first layer of said second electrode; and said at least an organic EL material is selected from the group consisting of poly (N-vinylcarbazole); poly(9,9-dihexylfluorene); poly(dioctylfluorene); poly{9,9-bis (3,6-dioxaheptyl)-fluorene-2,7-diyl}; poly(2-decyloxy-1,4-phenylene); poly(di-n-butylsilane); poly(di-n-pentylsilane); poly(di-n-hexylsilane); poly (methylphenylsilane); poly{bis(p-butylphenyl)silane}; 1,3,5-tris{n-(4-diphenylaminophenyl) phenylamino}benzene; phenylanthracene; tetraarylethene; coumarin; rubrene; tetraphenylbutadiene; anthracene; perylene; coronene; aluminum-acetylacetonate; gallium-acetylacetonate; indium-acetylacetonate; aluminum-(picolymethylketone)-bis{2,6-di(t-butyl)phenoxide}; scandium-(4-methoxy-picolylmethylketone)-bis(acetylacetonate); chelated oxinoid compounds; poly{2-methoxy-5(2'-ethyl-hexyloxy)-1,4-phenylene-1,2-ethenylene-2,5-dimethoxy-1,4-phenylene-1,2-ethenylene}; dibenzotetraphenylperiflanthene; polythiophene; perylene tetraesters; triphenylene hexaethers; amino-substituted perylene derivatives; azlactone derivatives; derivatives of pentacene; derivatives of pyran; porphyrins of platinum, palladium, europium, or zinc; malenitriledithiolate phosphonate complexes of platinum, palladium, or zinc; derivative of europium (III) phenanthroline; and iridium (III) bis{2-(2'-benzothienyl)-pyridinato-N-$C^{3'}$} (acetylacetonate).

[c28] 28.The organic electronic device of claim 20, wherein said device is an OELD.

[c29] 29.The organic electronic device of claim 28, wherein said first layer has a

thickness in a range from about 1 nm to about 25 nm, said second layer has a thickness in a range from about 10 nm to about 100 nm, and said third layer has a thickness in a range from about 10 nm to about 500 nm.

[c30] 30.The organic electronic device of claim 29, wherein said first and third layers comprise the same material that is selected from the group consisting of K, Li, Na, Mg, La, Ce, Ca, Sr, Ba, Al, Ag, In, Sn, Zn, Zr, Sm, Eu, alloys thereof, and mixtures thereof.

[c31] 31.The organic electronic device of claim 29, wherein said first and third layers comprise different materials that are independently selected from the group consisting of K, Li, Na, Mg, La, Ce, Ca, Sr, Ba, Al, Ag, In, Sn, Zn, Zr, Sm, Eu, alloys thereof, and mixtures thereof.

[c32] 32.The organic electronic device of claim 29, wherein said second electrically conducting material is an electrically conducting organic material, and is selected from the group consisting of polystyrene sulphonic acid, metalloporphyrins, copper phthalocyanine, and 8-hydroxyquinoline aluminum.

[c33] 33.The organic electronic device of claim 28, wherein said organic EL material is selected from the group consisting of poly(N-vinylcarbazole); poly(9,9-dihexylfluorene); poly(dioctylfluorene); poly{9,9-bis(3,6-dioxaheptyl)-fluorene-2,7-diyl}; poly(2-decyloxy-1,4-phenylene); poly(di-n-butylsilane); poly(di-n-pentylsilane); poly(di-n-hexylsilane); poly(methylphenylsilane); poly{bis(p-butylphenyl)silane}; 1,3,5-tris{n-(4-diphenylaminophenyl) phenylamino} benzene; phenylanthracene; tetraarylethene; coumarin; rubrene; tetraphenylbutadiene; anthracene; perylene; coronene; aluminum-acetylacetonate; gallium-acetylacetonate; indium-acetylacetonate; aluminum-(picolymethylketone)-bis{2,6-di(t-butyl)phenoxide}; scandium-(4-methoxy-picolylmethylketone)-bis(acetylacetonate); chelated oxinoid compounds; poly {2-methoxy-5(2'-ethyl-hexyloxy)-1,4-phenylene-1,2-ethenylene-2,5-dimethoxy-1,4-phenylene-1,2-ethenylene}; dibenzotetraphenylperiflanthene; polythiophene; perylene tetraesters; triphenylene hexaethers; amino-substituted perylene derivatives; azlactone derivatives; derivatives of pentacene; derivatives of pyran; porphyrins of platinum, palladium, europium, or zinc;

malenitriledithiolate phosphonate complexes of platinum, palladium, or zinc; derivative of europium (III) phenanthroline; and iridium (III) bis{2-(2'-benzothienyl)-pyridinato-N-$C^{3'}$}(acetylacetonate).

[c34]

34.An OELD comprising:

(a)a first electrode;

(b)a second electrode that comprises a first layer of a first electrically conducting material, a second layer of a second electrically conducting material disposed on said first layer, and a third layer of a third electrically conducting material disposed on said second layer; and

(c)at least an organic EL material disposed between said first electrode and said first layer of said second electrode;

wherein said first electrode comprises a substantially transparent electrically conducting material; said first and third electrically conducting materials of said second electrode are independently selected from the group consisting of K, Li, Na, Mg, La, Ce, Ca, Sr, Ba, Al, Ag, In, Sn, Zn, Zr, Sm, Eu, alloys thereof, and mixtures thereof; said second layer of said second electrode comprises a material selected from the group consisting of polystyrene sulphonic acid, metaloporphyrins, copper phthalocyanine, and 8-hydroxyquinoline aluminum; said first layer of said second electrode has a thickness in a range from about 1 nm to about 25 nm; said second layer has a thickness in a range from about 10 nm to about 100 nm; said third layer has a thickness in a range from about 10 nm to about 500 nm, said thicknesses being measured substantially perpendicularly to said first layer of said second electrode; and said at least an organic EL material is selected from the group consisting of poly(N-vinylcarbazole); poly(9,9-dihexylfluorene); poly(dioctylfluorene); poly{9,9-bis (3,6-dioxaheptyl)-fluorene-2,7-diyl}; poly(2-decyloxy-1,4-phenylene); poly(di-n-butylsilane); poly(di-n-pentylsilane); poly(di-n-hexylsilane); poly (methylphenylsilane); poly{bis(p-butylphenyl)silane}; 1,3,5-tris{n-(4-diphenylaminophenyl) phenylamino}benzene; phenylanthracene; tetraarylethene; coumarin; rubrene; tetraphenylbutadiene; anthracene; perylene; coronene; aluminum-acetylacetonate; gallium-acetylacetonate; indium-acetylacetonate; aluminum-(picolymethylketone)-bis{2,6-di(t-butyl)phenoxide};

scandium-(4-methoxy-picolylmethylketone)-bis(acetylacetonate); chelated oxinoid compounds; poly{2-methoxy-5(2'-ethyl-hexyloxy)-1,4-phenylene-1,2-ethenylene-2,5-dimethoxy-1,4-phenylene-1,2-ethenylene}; dibenzotetraphenylperiflanthene; polythiophene; perylene tetraesters; triphenylene hexaethers; amino-substituted perylene derivatives; azlactone derivatives; derivatives of pentacene; derivatives of pyran; porphyrins of platinum, palladium, europium, or zinc; malenitriledithiolate phosphonate complexes of platinum, palladium, or zinc; derivative of europium (III) phenanthroline; and iridium (III) bis{2-(2'-benzothienyl)-pyridinato-N-C$^{3'}$} (acetylacetonate).

[c35] 35.The organic electronic device of claim 13, wherein said device is an organic photovoltaic ("PV") device, and said at least an electrically and optically active organic material comprises two organic semiconducting materials that form a heterojunction.

[c36] 36.The organic electronic device of claim 20, wherein said device is an organic PV device, and said at least an electrically and optically active organic material comprises two organic semiconducting materials that form a heterojunction.

[c37] 37.A light source comprising a plurality of organic electroluminescent devices ("OELDs") disposed on a support, each of said OELDs comprising:

(a)a first electrode;

(b)a second electrode that comprises a first layer of a first electrically conducting material, and a plurality of elongated members that comprise a second electrically conducting material, and that are disposed on said first layer;

(c)at least an organic EL material disposed between said first electrode and said first layer of said second electrode;

wherein a thickness of said elongated members is greater than that of said first layer, said thickness of said elongated members being measured substantially perpendicularly to said first layer.

[c38] 38.A light source comprising a plurality of OELDs disposed on a support, each of said OELDs comprising:

(a)a first electrode;

(b)a second electrode that comprises a first layer of a first electrically conducting material, a second layer of a second electrically conducting material disposed on said first layer, and a third layer comprising a third electrically conducting material disposed on said second layer, said second electrically conducting material having conductivity less than those of first and third electrically conducting materials; and

(c)at least an organic EL material disposed between said first electrode and said first layer of said second electrode;

wherein a thickness of said third layer is greater than that of said first layer.

[c39] 39.An electrical energy source comprising a plurality of organic PV devices disposed on a support, each of said organic PV devices comprising:

(a)a first electrode;

(b)a second electrode that comprises a first layer of a first electrically conducting material, and a plurality of elongated members that comprise a second electrically conducting material, and that are disposed on said first layer;

(c)an electron donating organic semiconducting material and an electron accepting organic semiconducting material, said organic semiconducting materials being disposed between said first electrode and said first layer of said second electrode so as to form a heterojunction;

wherein a thickness of said elongated members is greater than that of said first layer, said thickness of said elongated members being measured substantially perpendicularly to said first layer.

[c40] 40.An electrical energy source comprising a plurality of organic PV devices disposed on a support, each of said organic PV devices comprising:

(a)a first electrode;

(b)a second electrode that comprises a first layer of a first electrically conducting material, a second layer of a second electrically conducting material disposed on said first layer, and a third layer comprising a third electrically conducting organic material disposed on said second layer, said second electrically conducting material having conductivity less than those of first and

third electrically conducting materials; and

(c)an electron donating organic semiconducting material and an electron accepting organic semiconducting material, said organic semiconducting materials being disposed between said first electrode and said first layer of said second electrode so as to form a heterojunction;

wherein a thickness of said third layer is greater than that of said first layer.

[c41] 41.A method for making an organic electronic device, said method comprising:

(a)providing a first electrode;

(b)disposing at least an electrically and optically active organic material on said first electrode;

(c)disposing a first layer of a second electrode on said at least an electrically and optically active organic material, said first layer comprising a first electrically conducting material; and

(d) disposing a plurality of elongated members comprising a second electrically conducting material on said first layer;

wherein a thickness of said elongated members is greater than that of said first layer, said thickness of said elongated members being measured substantially perpendicularly to said first layer.

[c42] 42.The method of claim 41, wherein said providing said first electrode comprises: providing a substantially transparent substrate, and disposing a first electrode material on said substrate.

[c43] 43.The method of claim 41; wherein said disposing said first electrode material, said disposing said first layer of said second electrode, and said disposing said plurality of said elongated members comprise depositing an electrically conducting material by a method selected from the group consisting of physical vapor deposition, chemical vapor deposition, and sputtering.

[c44] 44.The method of claim 43, wherein said disposing said plurality of said elongated members further comprises depositing an electrically conducting material using a mask.

[c45] 45.The method of claim 43, wherein said disposing said plurality of said

elongated members comprises disposing a layer of said second electrically conducting material, and selectively etching said layer so as to leave behind said plurality of elongated members.

[c46] 46.The method of claim 41, wherein said disposing said at least an electrically and optically active organic material is carried out by a method selected from the group consisting of physical vapor deposition, chemical vapor deposition, spin coating, dip coating, spraying, and ink-jet printing.

[c47] 47.A method for making an organic electronic device, said method comprising:
(a)providing a first electrode;
(b)disposing at least an electrically and optically active organic material on said first electrode;
(c)disposing a first layer of a second electrode on said at least an electrically and optically active organic material, said first layer comprising a first electrically conducting material; and
(d)disposing a second layer comprising an electrically conducting material on said first layer; and
(e)disposing a third layer comprising a third electrically conducting material on said second layer;
wherein said second electrically conducting material has conductivity less than those of said first and third electrically conducting materials, and a thickness of said third layer is greater than that of said first layer.

[c48] 48.The method of claim 47, wherein said providing said first electrode comprises providing a substantially transparent substrate, and disposing a first electrode material on said substrate.

[c49] 49.The method of claim 47; wherein said disposing said first electrode material, and said disposing said first and third layers of said second electrode comprise depositing electrically conducting materials by a method selected from the group consisting of physical vapor deposition, chemical vapor deposition, and sputtering.

[c50] 50.The method of claim 47, wherein said disposing said at least an electrically

and optically active organic material, and said disposing said second layer are carried out by a method selected from the group consisting of physical vapor deposition, chemical vapor deposition, spin coating, dip coating, spraying, and ink-jet printing.